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DoD
Tele-
Communications

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DoD's New Telecommunications Priorities – pg. 2

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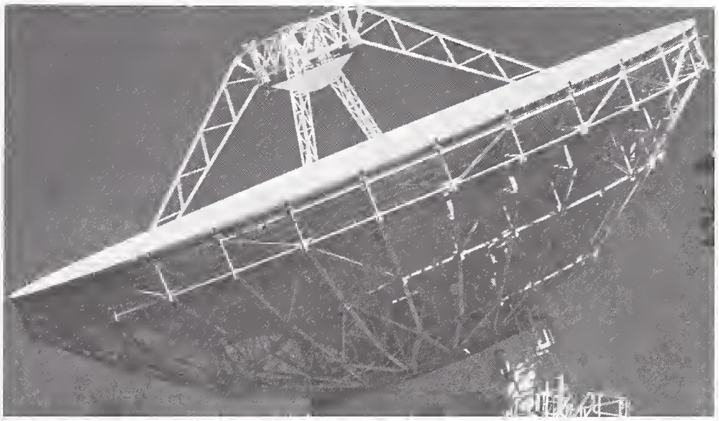

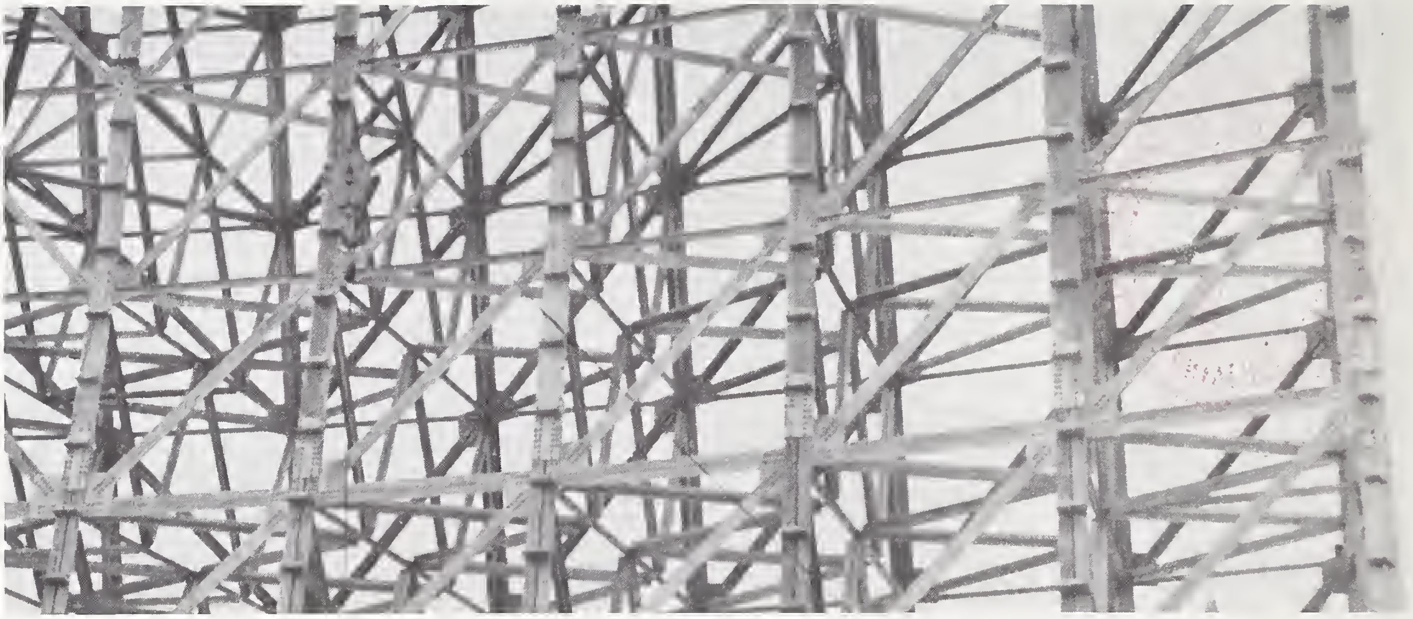

Space age antenna systems relay Department of Defense telecommunications to sites worldwide.
(U.S. Air Force Photo)

Overview

DoD Telecommunications: Reliable, Survivable, Secure

Defense telecommunications priorities depend on the kind of communications and the priority of the activity supported. About a year ago, after considering the status of Defense telecommunications and the new priorities of strategic and tactical communications, and thinking ahead to the needs of an investment strategy, the generalized priorities for critical Defense communications were defined as **reliability, survivability, security, and cost effectiveness, in that order.** In each case, if the higher priority characteristic is not reasonably met, the lower priority characteristic is of doubtful value.

Parenthetically, one reason that cost effectiveness is relatively low in priority is certainly not disinterest in good financial management but stems from an inherent difficulty to estimate cost effectiveness of any supporting activity—**a few dollars saved in telecommunications support can have a much larger impact in command and control, or logistics support, or force effectiveness.** Cost-effectiveness in Defense telecommunications is thus a matter of choice of least cost-options, all of which must provide appropriate reliability, survivability and security.

The acceptable level of telecommunications reliability and survivability is determined by the reliability and survivability of the forces or functions served. It is hard to justify communications with a military force, be it an infantry unit or a Poseidon submarine, which is either far more or far less survivable than the platoon or submarine itself.

The acceptable level of security depends upon the application and the threat. The security situation is best summed up by stating that **it is now Department of Defense policy that all future military voice radio procurements will be of equipment that are either secured or readily securable.**

Communication Strengths

The Defense Communications System, managed by the Defense Communications Agency (DCA) with operations by the Services, is providing efficient and cost-effective service measured against similar service provided in the civil sector. DCA satisfies requirements in these communication services:

- Secure message traffic occurs routinely, even with allies;
- Precedence message traffic flows rapidly through the communications trunks, blockages when they occur are now in the accesses from the users to the backbone trunks;

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- Automation and consolidation of telecommunications facilities is proceeding as well as financing can permit within the individual Services; inter-Service consolidation has been notably slower.

Improvements Sought

Generally, Defense telecommunications as a supporting activity has lagged behind the command and control, sensors and weapons it supports. The lag began to be recognized by both the Executive and Legislative Branches of the Government several years ago as a result of several bad incidents, including the Pueblo and Liberty cases.

There was also the recognition at both Presidential and Cabinet level that improved command control of U.S. strategic nuclear forces was necessary. An adequate and survivable command, control and communications system is just as much a part of the Nation's deterrent as the ICBM, SLBM, or manned aircraft. The credibility and capability to retaliate is dependent upon a reliable, survivable Defense communications system.

Unless the means are available for the National Command Authority to command and control the delivery systems, there is no deterrence.

Other communications improvements also are being addressed:

- Satellite communications will have some serious gaps in the near-term due to previous lack of decisive long-term planning and Defense-wide system management.
- Naval communications with ships is archaic compared to that of U. S. aircraft and ground forces. More than other mobile forces, the Navy is almost solely dependent upon high frequency radio with its numerous and vulnerable shore stations on foreign soil, its limited capacity and high error rates, its susceptibility to direction-finding and communications intercept at great distances, its large antennas and equipment, and its constantly shifting propagation characteristics.

Unfortunately, even after the Navy remedies this situation for its forces, communications with American allies will be limited to this same high frequency radio and the Nation could lose much of the limited operability it now has with its allies.

The naval situation is becoming rapidly more serious as the Soviets increase their surveillance and their anti-ship efforts, requiring, among other things, much better warning and intelligence data transfer to and among U. S. and allied fleets. The Navy, literally, is still back in the letter-and-telegram mode of command and control of its ships at a time when instant voice and computer-to-computer communications provides the only mechanisms fast enough to respond to predictable battle situations.

Communications Security

Recognition of the needs for joint operations and much improved communications security has resulted in a deliberate postponement of tactical equipment procurements until a Defense-wide telecommunications system architecture has been established adequate to insure reasonable interoperability and end-to-end communications security. A conscious risk has been taken that the existing inventory will suffice until the new class of equipment is produced and deployed.

Dr. Rechtin Led Way to Effective Telecommunications

Dr. Eberhardt Rechtin has been Assistant Secretary of Defense (Telecommunications) since February 15, 1972, after serving in an active capacity one month earlier. His previous communications posts include that of Principal Deputy Director of Defense Research and Engineering from December 1970 to February 1972 and Director, Advanced Research Projects Agency from November 1967, to December 1970.

In his capacity as Assistant Secretary of Defense (Telecommunications) Dr. Rechtin has led the way in bringing about a more effective and efficient telecommunications system for DoD by:

- **Establishing basic Defense policy for telecommunications, thereby matching telecommunications requirements and acquisitions to priority Defense and National needs.**
- **Chairing the U. S. Communications Board and developing policies that provide the needed ability to interoperate with our allies in a survivable and secure manner.**
- **Leading the U. S. delegation to the NATO Joint Communications and Electronics Committee in major new initiatives to establish cooperative support for NATO communications.**

DR. EBERHARDT RECHTIN
Assistant Secretary of Defense
(Telecommunications)

Dr. Rechtin communicates directly with the Secretaries of the Military Departments, the Joint Chiefs of Staff and the Directors of various Defense Agencies on matters relating to telecommunications. It is at this Pentagon level that he exchanges information and provides guidance on various technical and program matters.

ANTENNA—An Army installed ultra-high frequency satellite communications terminal AN/ARC-146 provides this helicopter with long-distance communications capability. The antenna is mounted atop the aircraft's rotor blades. (U.S. Army Photo)

Each equipment type, intended for use by all Services, is assigned for development to a single Service. Automatic, multi-channel switched communications, compatible with the long haul Defense Communications System, are being extended to lower levels of tactical command.

These moves mean a considerable investment, compared to previous years, in tactical system engineering and in system-critical equipments such as the TRI-TAC TTC-39 switch and its associated communications security subsystem. They are designed to operate in an end-to-end secure fashion through many links, and in technical control equipments for efficient operation of the transmission links.

Another major element in the investment strategy is the de facto establishment of a continuing satellite communications capability. This is in recognition that the days of R&D experimenting in such communications are largely over, that the Services cannot properly plan their total communications without knowing whether communications satellites will exist or not and that operational experience with the R&D satellites has shown them to be unique and vital.

Future Of Communications Satellites

It also appears that communications satellites can be made as survivable to nuclear and electronics attack as other general communications means. The investment consequences are to budget for replenishment satellites, to fund conservatively until successful operation has been demonstrated, and to provide a guaranteed service for a known annual cost. This strategy is being applied to the Defense Satellite Communications System II (DSCS II) and the upcoming Fleet SATCOM. Both satellite programs have inherent growth capability—much like the INTELSAT IV in the civil sector—and a hard-headed management of this growth should continue or expand the guaranteed service level at less and less cost per channel mile.

Air Force Technical Sergeant L. C. Schroeder receives data on in-bound aircraft at Indian Springs Bombing Range, Nevada. (U.S. Air Force Photo)

TELECOMMUNICATION — Aerial view of a communications station operated by the U.S. Navy on the Plains of Marathon near Nea Makri, Greece.
(U.S. Navy Photo)

Pending successful completion of R&D just starting, a similar arrangement for highly survivable satellites should probably be made some years hence. Lack of this investment strategy is causing a serious gap in UHF satellite communications service in the Pacific now and worldwide in about a year. A gap filler is required. The same gap is putting perhaps too much pressure on the Fleet SATCOM Development now; good planning, might have started the Fleet SATCOM two years earlier.

Potential Tradeoffs

The investment strategy for improving communications security is a tradeoff among the risks of delay, the very high cost of modifying or replacing a large inventory of military voice radios, the remaining engineering uncertainties in the specialized security devices, and the rapidly dropping costs of the digital components which make up more and more of the secure radio equipments. Thus, the first element in the investment strategy is to stop buying radio transmitters and receivers that can't be secured and, as the inventory needs replenishment, to buy either secured or securable radios instead.

The second element is to buy limited quantities of present designs of secured radios for intensive test and evaluation, thus determining what features are essential and which ones are not, and simultaneously to start an aggressive engineering effort to procure a lower cost design. Also, after some years of exploratory R&D on several different kinds of COMSEC equipments, the U. S. is now concentrating on those which will fit to the maximum extent possible into a consistent system architecture of end-to-end, go-anywhere communications security.

Automated Communications

A missing element in U. S. investment strategy is the financing of automation of telecommunications centers, particularly the message processing and distribution functions. These centers are heavily manual. Even when run by the most careful and dedicated people, they are easily saturated by the communications overloads, are unnecessarily expensive in manpower, and are a potential source of error and perhaps security leaks. Most of the automation of large centers would pay for itself in reduced direct costs, particularly if manpower costs continue to rise as rapidly as they have in the past.

The financing problem is that there does not exist at the moment a mechanism similar to that in the civil sector (common carriers, for example) which would permit capital investment to be paid for directly out of reduced operating costs. At present, capital investment is separately budgeted and requested, and manpower saved by automation does not result in a direct and obvious reduction in the total Defense manpower size. But, in principle, it should be possible for Defense to do what the common carriers have done: automate without increase in cost of service if not a reduction in cost.

One critical element of the investment strategy, that for improving the nuclear survivability of SIOP (Strategic) communications, is still in its process of being developed. Certain elements, such as improving survivability by going airborne (the Advanced Airborne Command Post), doing R&D on likely candidates (survivable satellites, extremely low frequency transmission to submarines) and fixing deficiencies in present systems (TACAMO, PACCS) are known from analyses to be good building blocks.

Functional Communications

The overall rationale necessarily depends upon the evolving national policies of strategic deterrence and sufficiency. It is not so much a question of whether individual strategic communication elements should be survivable as it is to what degree, against what level of threat, and for how long after an attack has started. These questions depend upon what transattack command and control functions are believed necessary in the national interest. Costs go up rapidly with increased survivability. The present partial-investment strategy is to understand what options might be available and at what cost.

There is also a dilemma in the investment policy for increasing secure voice capability within the Defense Communications System. In the mid to late 1980s, digital transmission systems will become widespread within civil telephone plants. These systems will lend themselves to relatively economical achievement of end-to-end secure voice capability within the community of DCS subscribers and between that community and the community of TRI-TAC subscribers.

Prior to this, a system for greatly increasing the availability of secure voice communications within the DCS is needed. This system will not, however, use the digital transmission of the 1980s. The dilemma is that the alternative is to do nothing about secure voice capability in the late 1970s and early 1980s. To date, DoD has found this alternative to be unacceptable.

Thus, DoD plans to implement the interim system (AUTOSEVOCOM Phase II), but is doing so in a manner which will hopefully minimize the replacement problem in the 1980s. It is believed this approach will lead to a lower cost for secure voice service over a 20-year program than other possibilities which have been considered.

Budget, People Cost

This investment strategy must fit within a consolidated telecommunication budget of about $2.5 billion per year. Fitting within that amount is more difficult than it might appear because almost 70 percent of that amount is for operations—the cost of people in DoD and its leased communications services. As is true in the rest of DoD, the total number of military and civilian personnel in Defense communications has decreased, but the total personnel costs have gone up. Considering the technical nature of communications, DoD's total personnel costs are too high relative to the total budget, a fiscal indication that Defense telecommunications is not sufficiently automated. A closer look at the problem shows that the trouble is in the message preparation and message distribution areas, both of which are highly manual operations at present.

Fortunately for Defense telecommunications, support appears highly probable. The telecommunications situation is well understood by both the military and civilian leaders in DoD.

Better communication is certainly supported by those who advocate a stronger Defense posture and by those who would reduce U. S. forces but improve their command and control as a way of maintaining effective national security.

A number of measures have already been taken to bring Defense telecommunications into better balance with the effectiveness of the rest of the DoD forces. Along with intelligence, telecommunications was raised to the Assistant Secretary level in the Office of the Secretary of Defense. These Assistant Secretaries were joined by the Chairman, Joint Chiefs of Staff in a streamlined decision council chaired by the Deputy Secretary of Defense.

Command And Control

Development has started in earnest on more survivable communications for command and control. Secure voice development is being expedited based on years of research and advanced development. Joint tactical communications development has been reorganized and redirected. Defense satellite communications are being focused and planned on a long term basis. The United States is taking a much more vigorous role in NATO telecommunications and in making U. S. and NATO communications interoperable.

The changes in Defense telecommunications are also clearly reflected in the budget. Despite limitations in the total Defense budget and consequent limitation of the budgets of the Services, the budget for telecommunications is perhaps the best evidence of the seriousness with which the Services and the Department of Defense view the present telecommunications imbalance.

Satellite Communications

SATCOM—Army Project Manager

The U. S. Army Satellite Communications (SATCOM) Agency is the Army project-manager organization for satellite communications. The agency is responsible for providing the earth environment for all Department of Defense satellite communications systems. The agency also represents the Army in special Defense Department satellite communication projects and acts as the Army's agent in international satellite communications programs.

SATCOM designs and develops earth terminals for satellite communications and other satellite systems for all-Service use. The agency conducts test programs for all military satellite communications systems in both the research and operational stages.

The agency is involved in both strategic and tactical satellite communications. In strategic communications, the global Defense Satellite Communications System (DSCS) is operational.

Internationally, SATCOM has had a leading part in the cooperative North Atlantic Treaty Organization program in tactical satellite communications research and development. The agency also gives technical assistance to NATO nations in their development of earth terminals for long-range satellite communications systems.

SATCOM is developing earth terminals for installation in a direct communications link to replace cable and high frequency radio links for Presidential use between the United States and the Soviet Union.

As the Army's source for systems engineering in satellite communications, SATCOM has the task of continually exploring all aspects of the ground environment. It also maintains an engineering test facility, comprising terminal equipment and a system simulation facility and including satellite simulators, the only one of its kind, which permits a complete "fly before buy" technology to be implemented.

Naval Telecommunications Restructured

To assess the state of Naval Communications after the publication of the Mollohan Report in May 1971, the Chief of Naval Operations (CNO) established the CNO Industry Advisory Committee for Telecommunications (CIACT) in August 1971 and tasked the group with conducting an in-depth study of naval communications and making recommendations for improvement. Committee members were a select group of industry and government experts in modern communications technology, management and operations. In order to obtain a thorough understanding of naval communications, committee members visited a wide variety of Navy commands and held discussions with many high level Defense Department and other senior government telecommunications officials. A formal report of findings was presented to the CNO in July 1972.

The CIACT report reaffirmed that, by its very nature, communications service in support of command and control of naval forces by the National Command Authorities cannot be significantly curtailed, regardless of the number of fleet units, as long as those units must operate in all oceans. The communications service to and among operating forces must not be just equal but better. There are also a number of ways to achieve economies in operating costs while providing this "better" service. For instance some of these were ongoing at the time:

- Restructuring our shore communications facilities;
- Consolidation of message centers ashore to achieve economy of operation and reduce management overhead costs;
- Automation both afloat and ashore to substitute advanced machine tools for very expensive manual operation;
- Conversion of our transmission system to an all-digital mode for increased reliability and range;
- Management reorganization to provide more centralized control of the planning and programming for the Naval Telecommunication System; and,
- Providing for a Naval Telecommunication System Architect organization.

Such actions offer tangible benefits in the form of global force level reductions, and such intangible benefits as greater accuracy, speed of service and overall reliability.

Perhaps the most important and significant change for the Navy has been the implementation of the CIACT recommendation for restructuring the Naval Telecommunications Division within the CNO organization to include the Naval Telecommunications System Architect (NTSA).

The overall telecommunications system architecture for the total Naval Telecommunication System is being developed by the NTSA, and the Chief of Naval Material will acquire, install, and integrate these capabilities into ongoing systems. The systems architect organization evaluates operational requirements and constraints to develop the telecommunications system characteristics and basic configuration responsive to those requirements. The architecture organization also establishes performance specifications and general system specifications to the degree necessary to assure successful and orderly system acquisition processes.

To keep pace with our modernizing fleet, the system architecture organization is moving rapidly ahead in areas such as automation and switched systems, leading toward a cost-effective mix of reliability, survivability, security and covertness for modern naval operations

SATCOM SYSTEM—This big radome-covered "hearing egg" at U.S. Naval Communications Station, Guam, is a satellite communications facility, part of the worldwide Satellite Communications (SATCOM) Agency.
(U.S. Navy Photo)

and providing for more highly organized and efficient internal shipboard communications.

Fleet Communications

A global chain of highly reliable shore stations provides the backbone for the U.S. Navy's communication support of worldwide fleet operations. These stations and units make up the Naval Communications System. Strategically positioned around the world, they serve the fleet as shore-to-ship, ship-to-shore, and ship-to-ship relay links.

Navy shore communication facilities have a dual function. They provide the required tactical communications for the Navy's combat forces. They are also important links within the unified Defense communications system, providing long-haul, point-to-point circuitry as required and assigned.

The primary thrust of the Navy's effort in communications improvement is the application of a total system approach in trying to obtain, through orderly evolution, modularity, and ultra-reliability, a communications system which will be responsive in a digitalized, automated, and satellite-oriented future.

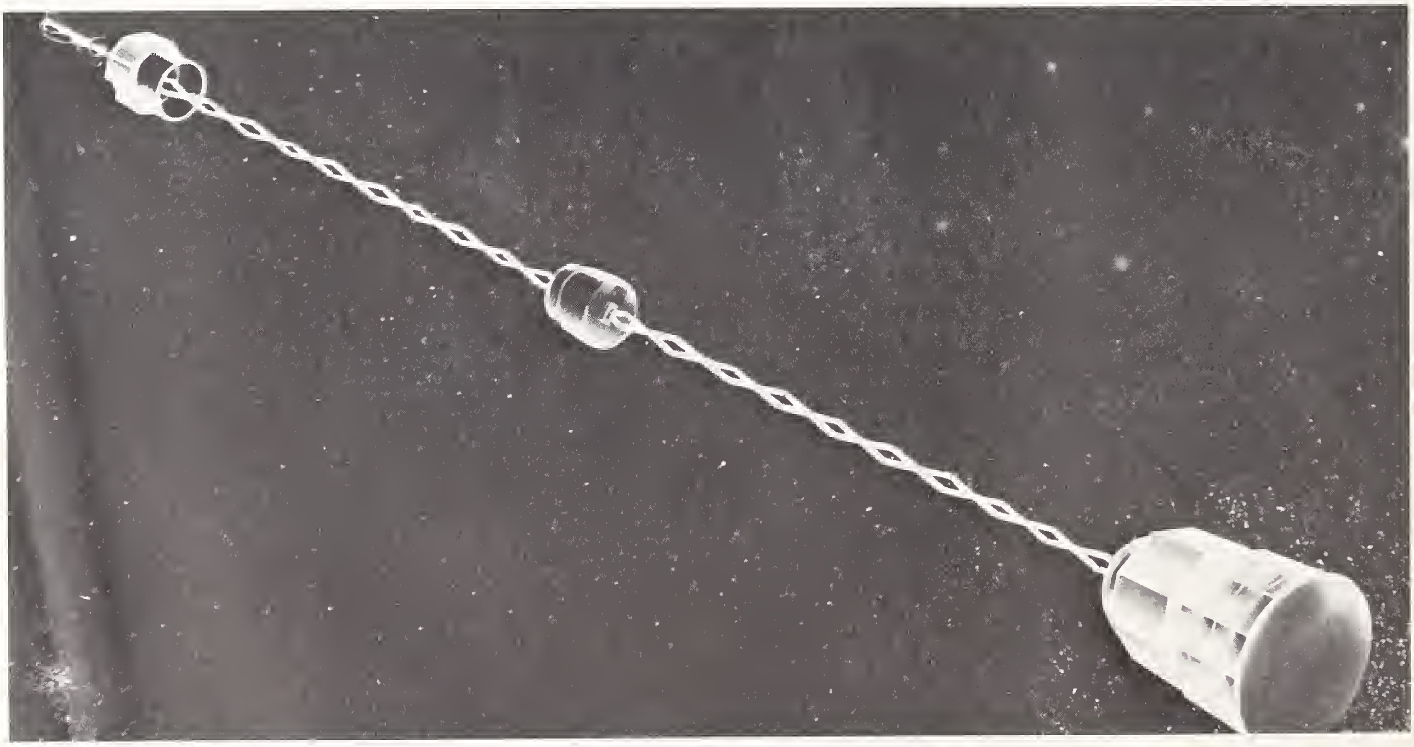
In order to improve communications beyond line-of-sight in the 1970s, the Navy looks increasingly to the advantages offered by the use of communications satellites. Present planning include a Fleet Satellite Communications System in stationary orbit, and the development, procurement and installation of terminal equipment aboard selected Navy fleet forces. The satellites will also be designed to accommodate certain high-priority Air Force users.

The communications automation program is designed to meet some of the objectives of naval communications through application of modern automatic data processing (ADP) technology and procedures. The approach being taken is to automate key nodal points of the Naval Telecommunications System in an evolutionary manner. The system will utilize new devices such as optional character readers (OCR), high-speed reproduction equipment, video display terminal (VDT) equipment, remote entry/display devices, and direct on-line computer interfaces, all operating under central processor control.

Automation

The CIACT group recommended continued automation programs. The Navy's Communications Automation program is being developed on a systems concept applicable to both shore and afloat units. The program consists of the Local Digital Message Exchange (LDMX), with its sub-system, the Naval Communications Processing and Routing System (NAVCOMMPARS). The latter is further divided into ashore and afloat sections. This automated system is modular in design, using standardized software and hardware to the maximum extent possible.

The systems design enhances both narrative message handling and distribution, plus data transfers. Although many command and control centers, and some major ships are computer and data oriented, their inputs and outputs must be converted into narrative format prior to exchange between ship and shore. This greatly multiplies the amount of information that must be digested by the readers, as well as overtaxing the communications facilities. The LDMX does away with this conversion. The Navy, recognizing the need for intra-DoD standardization and system compatibility, is working to reduce and streamline communications procedures plus formats in order to keep pace with technology and improve message handling in general.



New telecommunications satellites have helped make improvements in weather forecasting and all-weather navigation.
(U.S. Navy Photo)

Gen. Rienzi Explains Army Communications

Major General Thomas M. Rienzi, the Army's Assistant Chief of Staff for Communications-Electronics in a recent interview with Commanders Digest pointed up the Army's current communications-electronics activity.

Commanders Digest: What are the principal lessons learned about communications from the war in Vietnam?

Gen. Rienzi: *Vietnam proved again the applicability of the Army maxim that success in combat rests upon "shoot, move and communicate." The new family of single channel FM radios, which were developed in the 50s and procured in the early 60s made possible the successful employment of our enhanced air mobility and increased fire power. Another important lesson learned was the demonstrated requirement for early deployment of high-capacity, long-haul communications systems to serve the command and control needs of our senior commanders on the ground and connected with national command authorities; the expanded needs of the U.S. intelligence community; the vast data and management information needs of our logistic and support complexes and the national military and civil needs of our allies. The old Signal Corps slogan, "first in, last out," also was reaffirmed in Vietnam. We must have in-being contingency capabilities to insure that strategic communications can be readily provided. In this regard, the use of "packaged transportables" and the exploitation of satellite communications are most important. My final point on Vietnam is that when the crunch was on, because of rapidly growing requirements and delays in resources, the super performance of our dedicated and professional communicators carried the day. Their continued motivation, training and career development is our first priority concern.*

CD: What are now the communications equipment needs of overriding importance to the Army?

Gen. Rienzi: *I appreciate the limitations of space precludes a shopping list, so I will mention just three major items that are among the most important:*

- *We have a pressing need for a new family of single channel, secure, tactical radios, required principally for the forward combat units. Important features to be included are ultra-reliability, efficient and economical communications security, saving of critical frequency bandwidth and substantial reductions in size and weight.*
- *We are behind in providing automatic or computerized switches for our tactical multi-channel communications systems that provide voice, teletype and data service for our forces in the field. These are being developed under the Defense Department TRI-TAC Program and are essential to getting effective use of our multi-channel transmission facilities.*
- *Introducing a family of tactical communication satellite terminals including manpack, vehicular and transportable with assured access to designated satellite "birds".*

CD: Are there any new factors in the exploitation of electronic computers you feel worth commenting on?

Gen. Rienzi: *I believe that the automation of communications itself is perhaps the most dramatic advance in computer applications in the last couple of years. Our communications systems are being completely automated and, if I might say, digitalized from end-to-end, including input, transmission, switching and terminal message handling. We are giv-*

VERSATILE—This jeep-mounted super-high frequency terminal AN/MSC-58 can be used in any military situation and over terrain accessable to such vehicles. (U.S. Army Photo)

ing priority attention in communications automation to the development and maintenance of communications "software," which is the most critical and costly feature of automation. Another significant trend is the convergence of the communications and computer systems and technologies, which has led to new concepts and terms such as "teleprocessing." The closest coordination of planning, design and systems implementation is required for these two inseparable disciplines.

CD: We hear much lately about the congested radio frequency spectrum—what impact does this have on Army communications-electronics?

Gen. Rienzi: *In a nutshell, I can describe our dilemma as trying to cope with electronic pollution. This pollution is as real and pervasive as any of our other environmental pollution, such as air, water and noise. The radio frequency spectrum is being subjected to continually increasing numbers of electromagnetic emitters which are critical to every weapon, mobility and command and control system. At the same time civilian demand for the spectrum is also growing by leaps and bounds. At every level of government, this problem is being addressed, most notably by Dr. Whitehead, the Director of Telecommunications Policy in the Executive Office of the President. In the Army we have imposed stringent controls for every R&D program and new system implementation ranging from Safeguard radars to small battlefield sensors. Other positive measures include the anticipation of the spectrum data base and computer modelling of interference prediction; the development of new transmission media and an extensive education and indoctrination program for users and developers.*

CD: How do you feel the Army C-E will fare with the pinch on Defense resources?

Gen. Rienzi: *Army C-E is getting its fair share of Army resources, particularly money and manpower, and this will be the case for the future as we see the new Defense Five-Year Program emerge. We are working hard to insure tight control over our C-E resources and make sure scarce resources are used for only essential needs. The recent Consolidated Telecommunications Program of Dr. Rechtin, the ASD (Telecommunications), is proving to be equally useful at our level, as well as his, for getting a firm grip on communication costs and performance. Recent actions taken by the Army in FY 73 to provide centralized management over the leased communications data base and the development of traffic engineering standards are showing great promise. The Army Automated Telecommunications Program managed by USASTRATCOM, is providing economical message handling using computers and optical scanners. I remember when we used to describe our service as electrical communications; truly it has become electronic communications.*

Part of Defense System

AFCS Operates Worldwide Networks

The worldwide networks operated by the Air Force Communications Service (AFCS) tie together far-flung Air Force operations and constitute a valuable and major part of the overall Defense Communications System—the global system of teletype, facsimile, data and voice communications necessary for command and control of military forces. AFCS also operates beyond its worldwide range of networks by means of satellite communications.

In the area of digital communications, the AFCS-operated system of Automatic Digital Network (AUTODIN) switching centers provide a global capacity for handling over 40,000,000 punched cards daily, or the equivalent of about 600,000,000 words a day.

The Automated Weather Network (AWN) is considered to be the most advanced weather communications system in existence. Switches are equipped with central processor computers to collect weather data from minor relay centers in their area and send it immediately to the Carswell AFB, Texas, switch, composed of two high-speed digital computers. Carswell automatically transmits the data to the USAF Global Weather Central at Offutt AFB, Nebraska, where

CONTROLLERS—Air Force and civilian traffic controllers give instructions to in-bound aircraft while working the night-landing, light board at Templehof Central Airport, Berlin, Germany. (U.S. Air Force Photo)

SCATTER SITE—An Air Force sergeant checks the Humosa tropospheric scatter site atop a 2,700-foot mountain west of Torrejon Air Base, Spain. The installation conveys military communications rapidly over vast distances, linking various listening posts.
(U.S. Air Force Photo)

experienced weathermen aided by computers prepare forecasts for virtually all spots on the globe.

Also located at Carswell AFB is the hub of the USAF Notice-to-Airmen, or NOTAM, system, a far-reaching program designed to modernize the support given to military aircrews involved in worldwide flying operations.

The Automatic Voice Network (AUTOVON) provides the Department of Defense with a worldwide system for handling both voice and graphic communications on an automatically switched basis. AUTOVON links more than a million telephones, teletypewriters and high-speed data sets at some 2,000 military bases throughout the world.

The Automatic Secure Voice Communications (AUTOSEVOCOM) Network consists of automatic and manual switches, security devices, subscriber terminals and ancillary equipment, utilizing existing government-owned or leased transmission facilities. The system provides a means for voice communications up to and including Top Secret.

Altogether, AFCS' worldwide systems constitute one of the most sophisticated communications complexes in the history of electrical communications. Under any and all conceivable tactical, emergency, wartime or peacetime conditions, commanders can use the three systems to exercise instant command and control of their forces on a global basis from any point on earth, utilizing any available forms of electrical communications, whether it be satellite, troposcatter, land or ocean cable, or leased telephone lines.

Some 6,900 air traffic controllers operate the command's 350 control towers and radar facilities to provide control and guidance to the thousands of aircraft currently in the Air Force inventory.

In addition to their normal day-today air traffic control, controllers of AFCS have been kept busy during the 12 years of the command's existence helping military and civilian pilots safely out of dangerous situations. To date these dedicated men and women have been credited with "saving" 1,247 aircraft with more than 4,600 persons on board. Total cost of the aircraft was in excess of $1.3 billion.

As part of its worldwide air traffic control mission, AFCS operates a highly specialized operational evaluation program. Through systematic, periodic flight checks, dual-qualified pilot/controllers of the command's facility checking squadrons evaluate the effectiveness of air traffic controllers throughout the world. AFCS also maintains worldwide capability to conduct flight inspection of its mobile navigational aid equipment.

AFCS' Navigational Aids/Communications Management Office (NCMO) provides real-time management of communications-electronics services within the command. These NCMOs are established at all levels of command. Through the NCMO management structure, AFCS managers oversee thousands of circuits, traversing sites all over the world. These sites house navigational aids, weather intercept and satellite tracking stations, supply computers, aeronautical stations, weather teletype and facsimile terminals, base communi-

The issue of August 8, 1973, which excerpted the ARPA Congressional statement of Dr. S. J. Lukasik contained substitution of terms on page 5. ARPA's Climate Dynamics program was erroneously referred to as the Ecology program.

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FLARE

An Air Force C-141 aircraft lands with the aid of the ground control approach equipment in foreground. (U.S. Air Force Photo)

cations centers, mobile communications assets, switching centers of all types, telephone plants and hundreds of miscellaneous facilities.

Not always are fixed—or permanent—communications facilities available to support global Air Force operations. Thus, AFCS has five mobile communications groups located strategically around the world to respond to contingency communications requirements.

Except for the Third Mobile Communications Group, which reports directly to AFCS, the groups are aligned with their primary user-command to provide the responsiveness required in contingency operations, and operational control of the groups is exercised by that command. For example, Pacific Air Forces has operational control of the First Mobile Communications Group, U.S. Air Forces in Europe has control of the Second Mobile Communications Group and Tactical Air Command (TAC) has control of the Fourth and Fifth Mobile Communications Groups.

AFCS' mobile groups provide communications, air traffic control, and navigational aid facilities in situations where it is not practical to provide fixed facilities. They support war plans, contingency plans—in both peace and war—and emergencies; provide temporary facilities during exercises, maneuvers or special events; support requirements where fixed facilities are not yet in place; temporarily replace damaged or destroyed facilities, and support USAF major command-approved projects requiring temporary facilities.

In the late 1960s, the Air Force Communications Service became involved in a joint Service program to develop concepts for the use of communications satellites for highly mobile users. When the feasibility of such a system had been proved, the Joint Chiefs of Staff directed the employment of the residual assets of research and development satellite communications as an operational system.

The Air Force was chartered by the Joint Chiefs of Staff to be the lead Service to provide technical advice on operational system integration and was directed to assume the technical manager role.

Satellite communications will be direct, bypassing many relays we have today. This means high signal quality, greater reliability and minimal time of service.

AFCS has also represented the Air Force's interest in the defense satellite (DSCS) ground terminal development program by operating and maintaining a number of its ground stations. This long-haul, point-to-point, global system employs satellites which furnish a means of high data rate transmission as well as voice communications.

The future holds great promise in the area of satellite communications. Initial efforts have demonstrated the tremendous effectiveness and advantages of communications by this means.

It can be expected that AFCS will give thorough consideration to satellites when replacing or acquiring new communication systems, both strategic and tactical.

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